ADEQUACY OF LABELING OF MIXED TEXTILE FABRICS

by

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INTRODUCTION

An increasing number of fabrics containing two or more fibers is found on the open market today. The manufacture of spun rayon is largely responsible for this trend as the staple fiber lends itself to mixture with other fibers. Finishes often conceal the identity of the fiber so that informative labeling is the only means the consumers may have of knowing fiber content. Most consumers are interested in knowing what they are getting, and if they are paying the price of wool, they want wool.

It is important that the consumer be informed concerning the fiber content of fabrics because of the differences in using and caring for fabrics made of mixed fibers. It is essential for some consumers who are allergic to certain fibers to know the content of the fabrics they buy so as to avoid those known to give discomfort.

At the present time some textile fabrics are being labeled as to fiber content, use, and care. The Federal Trade Commission is encouraging the informative labeling of fabrics, and many merchants are attempting to give correct information to purchasers. This trend toward improvement in buying conditions will probably lead to more accurate labeling of mixed fabrics.

The purpose of the study was to ascertain the extent of labeling concerned with fiber identification, the percentage composition of certain mixed fabrics obtained on the open market, and to compare the information concerning fabrics given the consumer with facts as determined by quantitative analyses.

PRESENT STATUS OF KNOWLEDGE

No study has been found that dealt with the determination of fiber content with regard to adequate labeling.

Legislation has failed to develop a "truth in fabrics" bill. Several attempts have been made by the Federal Trade Commission to aid and protect the consumer in purchasing textiles. The Commission ruled in 1930 that "the word, wool, shall not be used in any way in the labeling, advertising or merchandising of knit underwear unless the percentage, by weight, of wool contained in the garment is stated". In 1932 labeling of wool and part-wool blankets with guaranteed minimum wool content was established as a commercial standard (1). The Federal Trade Commission (2) set up rules on October 26, 1937 for rayon trade practices in which provisions are made for clear and proper identification of rayons, including those in mixed fabrics, offered the consumer. "The rules are designed to foster and promote fair competitive conditions and the protection of the purchasing and consuming public in the interest of both industry and the public". The National Federation of Textiles (3) approve this measure and favor further compulsory identification. Progress in the identification of fibers in textile fabrics seems inevitable.

Mixed fabrics resulting from a combination of fibers may be achieved in 3 ways: the raw fibers may be mixed to form blends before spinning; fibers may be mixed in the form of ply yarns, each ply being made of a different fiber; and yarns of one fiber may be interlaced with yarns of another fiber in weaving.

Fiber identification may be made by means of the microscope, chemicals or dyes. One method can not be expected to serve with complete success for all fibers; so all three methods are used interchangeably. It is often advisable to confirm an identification by other tests rather than to rely on a single diagnosis.

According to Schwarz (4) no single method is as simple, readily duplicated and positive as microscopic identification. The microscope is generally used to check fiber identity before any chemical tests are made because microscopic determinations require less time and are more conclusive than chemical tests. A comparison of longitudinal and cross-sectional mounts of the unknown fiber with a series of known specimens is employed.

Mounts may be made in air, glycerin or Canada balsam. The optimum mounting medium for a fiber is the medium having an index of refraction different from that of the fiber. Air mounts are preferable for showing surface detail. Canada balsam mounts dry and thereby become permanent; but glycerin mounts must be sealed if they are to be preserved.

Many fibers can be identified by longitudinal mounts; but for identification of silk and the various rayons, cross-sectional mounts are necessary. Cross-sections of fibers may be made either by the Viviani-cork method or by embedding in paraffin (4). The cork method is the quicker and is quite satisfactory for identification purposes.

Cotton may be identified longitudinally by its rolled edges and the twists along the length of the fiber. Wool fibers are identified longitudinally by the presence of scales. Casts of wool and hair fibers may be made in collodion or colored finger-nail polish in order to study the scales in detail. It is difficult to distinguish mohair from wool due to the similarity of characteristics. According to von Bergen (5) the chief means of identification is in the spacing and characteristics of the scales. Linen is distinguished from cotton by the nodes appearing at intervals which are emphasized by polarized light. Silk and the rayons are readily differentiated in cross-sectional mounts. Silk is triangular; cuprammonium, round; cellulose acetate, lobed; and viscose has serrated edges.

Solution of cellulose acetate in acetone is a means of chemical identification commonly used because of its rapidity and positiveness. The xanthoproteic test and the test with Millon's reagent to distinguish animal fibers from vegetable fibers are well known, as is the caustic potash test for wool. Chemical tests for identification are used less frequently than microscopic because they often lack reliability.

Dyeing is a rapid method of identification and is often valuable as a check on other methods. Among the dyes used are methylene blue, Millon's reagent, Herzberg's solution, eosin, Neocarmin B and Neocarmin W. Neocarmin W has appeared for identification purposes within the last year and dyes each of the various fibers a different color. This dye is recommended for quick identification of the rayons since it colors viscose, purple; cuprammonium, red; and cellulose acetate, bright yellow.

The three fundamental ways of determining the fiber content quantitatively are mechanical, microscopic and chemical methods. When two different single yarns are interlaced or two yarns of different appearance are twisted together before weaving, the percentage composition can usually be determined mechanically. For those fabrics in which the raw fibers are mixed before spinning or the plys are not readily distinguishable from each other, the quantitative analyses must be either microscopic or chemical. Schwarz (4) stated that the analysis of textile fabrics with absolute certainty is a goal not yet achieved. No one method can be expected to serve with complete success for all fibers; so each method must be given due consideration.

While the identification of fibers is easily accomplished by the use of the microscope, the quantitative determination is difficult. There has been comparatively little work done on quantitative microscopic analysis. According to Schwarz (1) this gives a volumetric rather than a gravimetric analysis. Until better data are determined on the specific gravity of fibers, there will be difficulty in relating the findings from the microscopic analyses, which are volumetric, to the ordinary chemical analyses, which are gravimetric.

Because of the close similarity in the chemical composition of some fibers, they can not be analyzed chemically. Blends of cotton and linen, viscose and linen, wool and rabbit hair or mohair and wool are difficult or impossible to separate quantitatively by chemical means. Microscopic analysis is the only method applicable in such cases.

Herzog (6) has shown that the percentage of fiber present in a mixture may be found by the formula:

$$\text{per cent of fiber A} = \frac{100\ n_a\ g_a}{n_a\ g_a + n_b\ g_b}$$

when n is the number of fibers and g is the weight of each fiber per unit length. Skinkle (7) and von Bergen (5) have done analyses of wool and mohair by counting the number of each kind of fiber in a cross-section of yarn. Skinkle, (7) in his work on animal fibers which are nearly round in cross-section and of approximately the same density, has expressed the percentage by the equation:

$$\text{per cent of fiber A} = \frac{100\ n_a\ d^2{}_a}{n_a\ d^2{}_a + n_b\ d^2{}_b}$$

when d is the average diameter of the fibers and n is the number of fibers.

Chamot and Mason (8) give certain points which must be considered in order that the microscopic analysis be sufficiently accurate. First, the components of the mixture must differ enough in appearance to permit easy recognition. Second, the sample must represent the material to be analyzed and must be such that satisfactory checks may be obtained from duplicate determinations and from samples of known composition.

According to Schwarz (9) if an average of several determinations is taken in quantitative microscopic analysis the results are often more accurate than the results of chemical analysis. Chemical determinations that depend upon the action of a selective solvent on a fiber mixture may be inaccurate because of partial solution of the fiber which it is desired to retain. Another consideration is that of the varying density of the different fibers. Rayon has a much higher density than silk; therefore, a fifty-fifty yarn by weight will actually have a greater volume or number of silk filaments. The physical properties of the fabric depend more upon the number of fibers present or the relative amount of space occupied by each than upon their weight. Therefore volumetric analysis is as important as gravimetric although less commonly used.

Before proceeding with actual chemical analyses all non-fibrous natural constituents of the fiber and any substances added by the manufacturer should be removed. Starch, china clay, soaps, waxes and non-drying oils may be removed by carbon tetrachloride extraction and immersion in a starch and protein-solubilizing agent according to Committee D-13 (10). The authors do not claim complete removal of all possible substances since the delustered rayons and many of the newer treatments present special problems. Matthews (11) proposes boiling the yarn in a dilute solution of hydrochloric acid and then in sodium carbonate for the extraction of coloring matter and sizing. Krais and Markert (12) suggest alternate treatment with ether, alcohol, enzymes, dilute acids, dilute ammonia, benzol and carbon disulfide according to the nature of the non-fibrous matter present.

In chemical analysis the five fibers commonly considered are wool, cotton, silk, cellulose acetate and regenerated rayon. The method most frequently suggested for the removal of the cellulose acetate is solution in acetone. Since this method is accurate as well as simple, other methods are seldom suggested. Cryer (13) proposes the use of acetic acid as a solvent, but according to Edgar and others (14), this method is liable to a high percentage of error as is the use of analine.

According to Committee D-13 (10) silk may be removed from combinations with regenerated rayon, wool or cotton by solution in calcium thiocyanate of a definite specific gravity without affecting the other fibers. Lowe's reagent is suggested by Herzfeld (15) as a silk solvent showing little action on wool, cotton, or viscose. This method is also recommended by Matthews (11); but according to Trotman (10) it is liable to a high percentage of error due to the solution of some of the rayon. Besides the methods already mentioned, silk may be separated from cotton by solution in sodium hydroxide or ammoniacal nickel hydroxide known as Richardson's reagent. The cotton may be removed from a silk and cotton mixture by concentrated sulfuric acid. Silk and wool may be separated by the selective solvent action of Lowe's reagent, Richardson's reagent, calcium thiocyanate, dilute sulfuric acid or hot hydrochloric acid. Bray (17) applied a 3 per cent correction to the latter method for partial solution of the wool. Matthews (11) includes basic zinc chloride as a silk solvent giving a 2 per cent correction for wool. Ammoniacal copper oxide is suggested as a selective solvent for silk and wool by some authors; but according to Matthews (11) this method is not to be recommended because it is apt to be deleterious to the wool.

If regenerated rayon is present in a mixture with cotton or wool, it may be removed by solution in calcium thiocyanate of specific gravity 1.36 according to Committee D-13 (10). Trotman (16) claims this method is liable to a 2 to 4 per cent error due to the loss of wool and cotton. He claims there is no accurate method of separating regenerated rayon and cotton. It is always best to get the percentage of the fiber of greater amount directly, and the one of lesser amount indirectly. In a mixture containing more rayon than wool, the wool may be dissolved in a 5 per cent solution of potassium hydroxide leaving the rayon intact.

Wool and cotton are the two remaining fibers to be considered. The usual method has been treatment of the mixture with hot sodium or potassium hydroxide to remove the wool. The residue of cotton is weighed and a 3 to 6 per cent correction factor is applied to the cotton. Matthews (11) claims that potassium hydroxide is less harmful to the cotton than sodium hydroxide. This method is speedy and simple but it has some drawbacks. Wool, usually the more valuable and important component of the material, should be determined directly rather than by difference. Another disadvantage is that a variable and somewhat uncertain correction factor must be applied to the weight of cotton. The most successful method according to Nyberg (18) is the treatment of the sample with dilute hydrochloric acid followed by treatment with concentrated acid. The initial treatment with dilute acid causes partial hydrolysis of the cellulose and causes the fiber to be more susceptible to attack by strong acid. Other methods are solution of the cotton in moderately concentrated sulfuric acid, carbonization of cotton with aluminum chloride, and estimation of the wool by determination of the nitrogen content according to the Kjeldahl method. The latter method is impractical because it is time consuming and the results are variable.

It is impossible to separate bleached linen from cotton chemically because the cellulose of the two fibers is identical in chemical reaction. In all other combinations linen may be treated in the same manner as cotton due to their similarity.

PROCEDURE

Materials were purchased from department stores in towns and cities of various sizes. An attempt was made to select as wide a variety as possible consisting of various fiber combinations. The fiber content of the fabrics was determined by one of three methods before it was subjected to quantitative analysis. The most feasible appropriate method of quantitative analysis was chosen for each fiber combination.

Materials

Forty-two mixed fabrics were purchased from 11 department stores located in Kansas, Missouri, Illinois, and Wisconsin. All information concerning the fiber content of each fabric, which could be obtained either from a label or the salesperson, was recorded.

Identification

The fiber content of most fabrics was ascertained microscopically by comparing longitudinal and cross-sectional mounts with known mounts. Mounts of warp and filling fibers were made in glycerin. Cross-sections were prepared by the Viviani-cork method. A sewing machine needle was threaded with dental floss and pushed through a cork. The bundle of fibers was placed in the loop made by the floss and pulled into the cork by removal of the needle. After a drop of collodion had been applied to the end of the cork to hold the fibers in place, cross-sections were cut as thinly as possible with a razor blade and mounted in glycerin. Dark yarns were mixed with white viscose rayon in order to give the cross-section some degree of transparency. The mounts were studied under magnification with a 4 mm. objective and a 10x ocular. Casts of wool, alpaca and mohair fibers were made in collodion or colored finger-nail polish.

The microscopic identification of all acetate rayons was checked chemically by solution in acetone. In some cases the identity of wool was ascertained by treatment with Millon's reagent in which animal fibers turn brick red when warmed. Neocarmin W was used as an additional test for identification of fibers in cases of doubtful identity, especially for those fibers which could not be successfully cross-sectioned.

Quantitative determinations of fiber content were made either mechanically, microscopically, or chemically depending upon the nature of the fabric. Before proceeding with quantitative analysis 6 samples of approximately 5 grams of each fabric were desized according to the method of Committee D-13 (10). The samples were extracted for 2 hours with carbon tetrachloride in a Soxhlet extractor. After allowing them to dry in air, they were washed by repeated immersion in hot distilled water and squeezed between immersions. The specimens were then placed in a 3 to 5 per cent aqueous solution of Tekalab, a starch and protein-solubilizing enzyme, at 50 C. and thoroughly wet out by repeated squeezing. The enzyme solution was maintained at 50 to 60 C. for 1 hour. The sample was rinsed 12 times in fresh portions of hot distilled water to insure complete removal of sizing. The rinsed specimen was then dried to constant weight in a weighing bottle in an oven at 105 to 110 C. for 2 hours. The bottles were removed from the oven and cooled in a desiccator for one-half hour at room temperature. They were then weighed on an analytical balance after which the heating process was repeated. Samples were considered at constant weight when 2 consecutive weights checked within 0.003 grams. All weights for quantitative analyses were taken on the bone dry basis after the samples had been desized.

Quantitative Mechanical Analysis

Mechanical determination of percentage of fiber content was used whenever it was feasible. If the warp yarn was of one fiber and the filling yarn of another, the sample was easily separated mechanically. In some cases effect yarns of a different fiber than the background were distinguishable due to color or texture and were readily removed. Ply yarns of different kinds of fibers could be separated, especially if each ply was of a different color. The weight of each kind of fiber was found and the percentage calculated. If the results of the 2 samples differed more than 2 per cent, the experiment was repeated.

Quantitative Microscopical Analysis

The percentage of fiber content by weight of 3 samples was determined both by the use of the microscope and chemically. Microscopic counts can be made by cross-sections or longitudinal-sections of even fiber blends.

Two of the 3 samples were analyzed by the cross-section method. Yarns from the warp of a wool and viscose rayon blend (Plate I) were cross-sectioned by the Viviani-cork method. The specimen was mounted in glycerin and placed in the microscope with a 4 mm. objective and 10x ocular. A field was chosen at random and the entire number of wool and viscose rayon in the field was counted and recorded. This procedure was repeated 10 times for the warp yarns and 10 times for the filling yarns. The average number of wool and of rayon fibers was calculated. The relative areas of wool and viscose fibers were arrived at by drawing approximately 20 wool and 20 viscose rayon cross-sections on heavy paper with the aid of the camera lucida (Plate II). The cross-sections were cut out and weighed on the analytical balance. The average weight of the paper in the drawing of one wool cross-section and of one viscose rayon cross-section was calculated and taken as proportional to the size of the fiber. The formula

Plate I

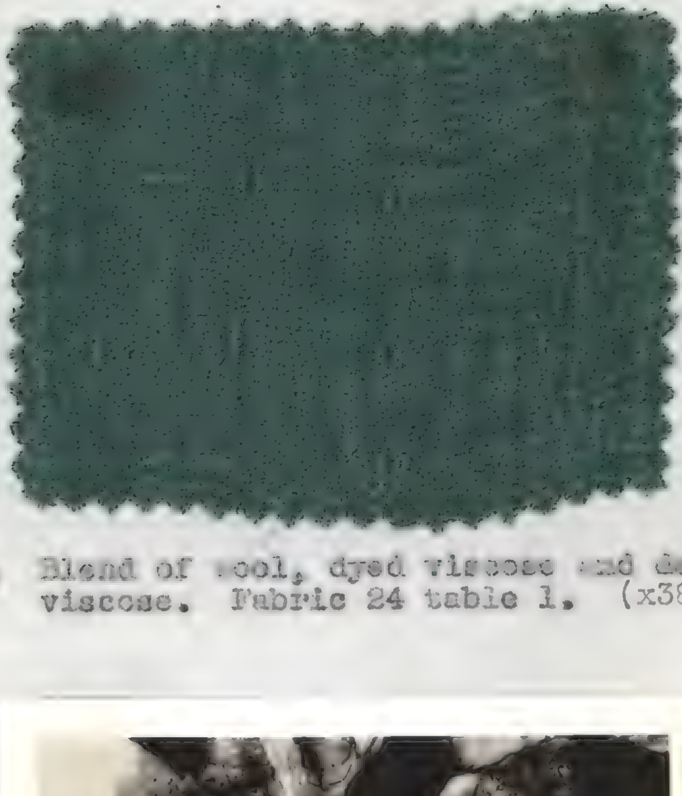

Fig. 1. Blend of wool, dyed viscose and delustered viscose. Fabric 24 table 1. (x380)

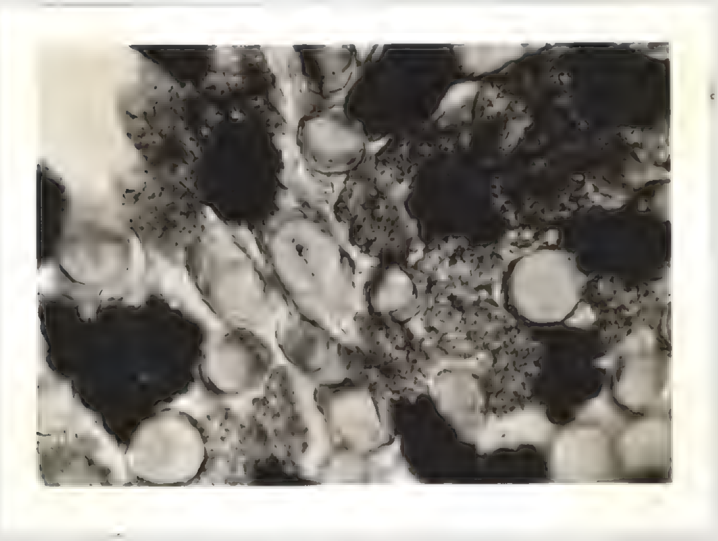

Fig. 2. Photomicrograph of a cross-section of a yarn from fabric 24 in table 1. (x380)

Plate II

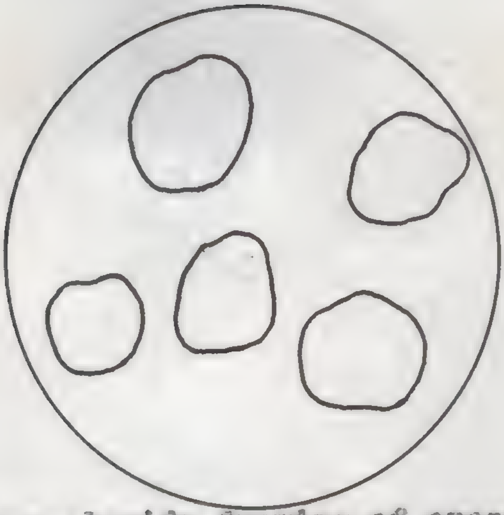

Fig. 1. Camera-lucida drawing of cross-sections of wool in fabric 24 table 1. (x600)

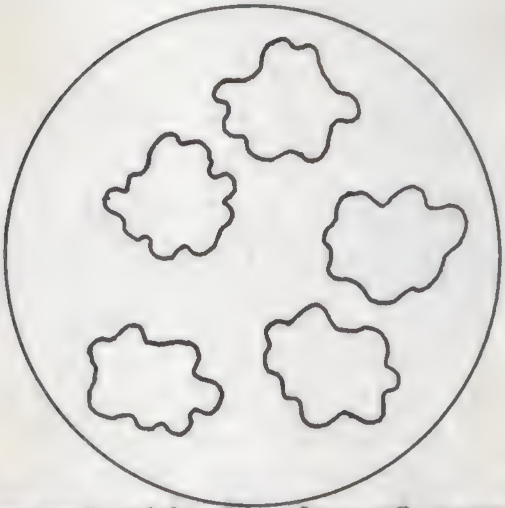

Fig. 2. Camera-lucida drawing of cross-sections of viscose in fabric 24 table 1. (x600)

used by Shinkle (7) was modified in that w, average weight of camera lucida drawings of the cross-section, was substituted for d^2, the average diameter of each fiber.

The percentage by volume of wool as fiber A in the blend was calculated by the following formula:

$$\text{per cent of fiber A} = \frac{100\, n_a\, w_a}{n_a\, w_a + n_b\, w_b}$$

The percentage by weight of wool can be expressed by the formula:

$$\text{per cent of fiber A} = \frac{100\, n_a\, w_a\, g_a}{n_a\, w_a\, g_a + n_b\, w_b\, g_b}$$

In the equations n is the number of fibers, w is the average weight and g is the specific gravity of the fiber. The values of the specific gravities were taken from Herzog (6) and the International Critical Tables (19).

The calculations for the microscopical analysis of fabric 24 in table I were as follows:

Counts of wool and viscose rayon in 20 fields.

Wool	Viscose Rayon
9	14
8	12
10	14
10	12
16	10
18	10
8	13
9	12
9	11
9	7
15	15
7	17

Wool	Viscose Rayon
6	7
13	10
8	8
9	9
11	9
9	13
8	8
10	6
20)202	20)217
10.1 average number of wool in 1 field.	10.8 average number of viscose rayon in 1 field.

Average weight of 20 wool cross-sections $\frac{.2954}{20} = .0148$ gram

Average weight of 20 viscose cross-sections $\frac{.3272}{20} = .0164$ gram

Percentage of fiber by volume:

per cent of wool =

$$\frac{100 \times 10.1 \times .0148}{(10.1 \times .0148) + (10.8 \times .0164)} = 45.8$$

per cent of viscose rayon =

$$\frac{100 \times 10.8 \times .0164}{(10.1 \times .0148) + (10.8 \times .0164)} = 54.2$$

Percentage of fiber by weight:

specific gravity of wool = 1.32

specific gravity of viscose rayon = 1.52

per cent of wool =

$$\frac{100 \times 10.1 \times .0148 \times 1.32}{(10.1 \times .0148 \times 1.32) + (10.8 \times .0164 \times 1.52)} = 42.3$$

per cent of viscose rayon =

$$\frac{100 \times 10.8 \times .0164 \times 1.52}{(10.1 \times .0148 \times 1.32) + (10.8 \times .0164 \times 1.52)} = 57.7$$

The percentage composition of fabric 4 in table 2, a sample of wool, silk and rabbit hair, (Plate III) was determined in the same manner.

The third sample, fabric 35 in table 2, was a blend of linen and viscose rayon which was analyzed by counting short lengths of fibers cut from a yarn. Short longitudinal sections, one-sixteenth of inch or less, were cut with a scissors, teased out on a slide and mounted in glycerin. Polarized light was used to aid in identifying the linen sections. A mechanical stage, which had 2 graduated scales at right angles, was manipulated in such a manner that the entire area under a cover glass was observed with a 16 mm. objective and a 10x ocular, and the fibers counted. Ten slides were prepared from yarns taken from various parts of the fabric, and the counts for each fiber were averaged. The average weight of camera lucida drawings of the cross-sections of each fiber was calculated. The preceding formulae were used to determine percentage of fiber content by volume and by weight.

Quantitative Chemical Analysis

Due to the multiplicity of methods for quantitative chemical analysis, a study was made to determine the one most satisfactory for the separation of each fiber in the mixture. Known weights of desized fibers were mixed and

Plate III

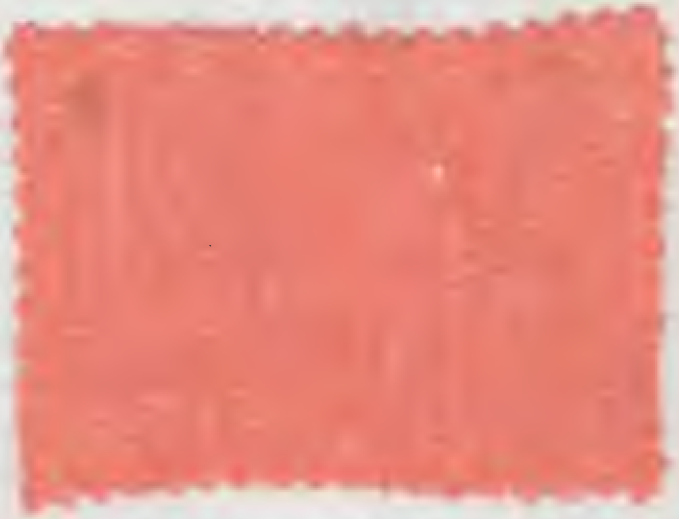

Fig. 1. Blend of silk, wool and rabbit hair. Fabric 4 table 2.

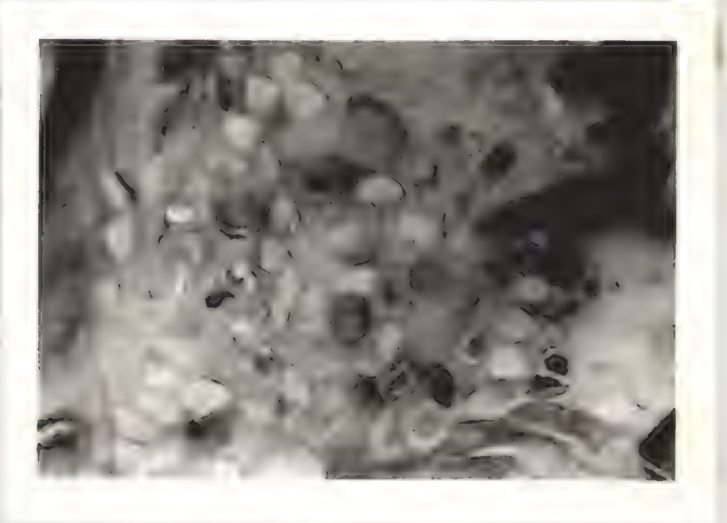

Fig. 2. Photomicrograph of a cross-section of a yarn from fabric 4 table 2. (x380)

then separated chemically by each of the possible methods. Several determinations were made for each method in order to decrease the probability of error in manipulation. The percentage of error for each method was tabulated and the most reliable methods for separating the various fiber mixtures were used in this study.

Cellulose acetate rayon was removed from mixtures with silk, viscose rayon and cuprammonium rayon according to the method of Committee D-13 (10). The specimen was agitated vigorously in the Launder-Ometer for 15 minutes in 250 ml. of acetone at room temperature. The residue was rinsed in 2 fresh portions of acetone. It was allowed to dry and then immersed in water at a temperature of 70 C. The water was removed by squeezing and the residue was dried to constant weight. The data were recorded and the percentage by weight of fiber content was calculated. The calculations for fabric 4 in table 1 were as follows:

	I	II
Average weight of bottle + sample------	33.6208	32.9065
Average weight of bottle----------------	28.7430	27.9180
Weight of sample----------------------	4.8778	4.9886
Average weight of bottle + residue-----	30.4974	29.7149
Average weight of bottle----------------	28.7430	27.9180
Weight of residue---------------------	1.7544	1.7969
Weight of cellulose acetate------------	3.1234	3.1917
Per cent cellulose acetate--------------	64.0%	63.9%

Silk was separated from mixtures with viscose rayon and wool according to the method described by Matthews (11). Love's reagent readily dissolved silk when it was immersed at room temperature for 20 minutes. After treatment with Love's reagent the residue was washed thoroughly to remove any deposit left on the fiber. It was found that if the residue was rinsed in a 1 per cent solution of hydrochloric acid, the gelatinous precipitate was readily removed. The residue was dried to constant weight and the percentage of silk calculated.

The regenerated cellulose rayon was separated from cotton by solution in calcium thiocyanate according to the method of Committee D-13 (10). The sample was agitated vigorously in the Launder-Ometer for 1 hour in 200 ml. of clear aqueous solution of calcium thiocyanate of specific gravity 1.35 to 1.36 at a temperature of 70 C. The solution was made just acid with acetic acid. The residue was washed with hot distilled water until free from thiocyanate and dried to constant weight. The percentage of regenerated cellulose rayon was calculated.

Wool was separated from mixtures with viscose rayon or cotton by dissolving the wool in potassium hydroxide according to the method described by Matthews (11). This method was used when the animal fiber made up only a small portion of the fabric. The specimen was boiled for 10 minutes in 200 ml. of a 5 per cent solution of potassium hydroxide in a flask fitted with a reflux condenser. The residue was rinsed in a dilute solution of acetic acid and then in distilled water. It was dried to constant weight and the percentage of wool calculated. A 3 per cent correction factor was applied to the viscose rayon.

When the regenerated cellulose fibers were in the minority in mixtures of wool and viscose rayon or cotton, they were removed according to Committee D-13 (10). The sample was immersed for 10 minutes in a boiling solution of aluminum chloride containing 9 grams of hydrated aluminum chloride per 100 ml. of water. It was removed from the solution; and after allowing the excess liquid to drain off, it was heated in an oven at 105 to 110 C. until the cellulose fiber had become brown in color and brittle. The specimen was placed on a 100-mesh screen and rubbed against the screen with sufficient pressure to powder the carbonized cellulose and pass it through. The material which passed through the screen was screened again to recover any wool fibers which passed through the first time. The wool was agitated in dilute hydrochloric acid and washed with distilled water until free from chlorides. The residue was dried to constant weight and the percentage of wool calculated.

FINDINGS AND DISCUSSIONS

The data obtained were tabulated and summarized. In each case the type of fabric was stated and the information on the label and that obtained from the salesperson in regard to fiber content was given. Also, for each fabric the manner in which the different kinds of fibers were combined, the method of analysis and percentage of fiber content were given. A fabric was considered accurately labeled if all the kinds of fibers which it contained was stated. It was considered partially accurate if one kind of fiber contained in the fabric was given correctly and the others were not. The information was considered inaccurate if none of the kinds of fibers in the fabric was stated correctly. Cellulose acetate rayon was considered accurately labeled if given as Celanese rayon, acetate rayon or acetate and only partially accurate as rayon or Celanese. Information in regard to the cuprammonium rayon was considered accurate if given as cuprammonium rayon, cuprammonium or Bemberg rayon and only partially accurate if given as Bemberg or rayon. In the case of viscose rayon, viscose rayon or viscose was counted as accurate and rayon as partially accurate.

Among the fabrics studied there were 12 different two-fiber combinations (Table 1) and 3 three-fiber combinations (Table 2). The majority of the fabrics tested contained cellulose acetate, cuprammonium or viscose rayon as one of the components. The most common mixture was cellulose acetate and viscose rayon.

Of the 42 fabrics analyzed 10 were labeled, and salesmen gave information concerning the fiber content of the remaining 32. The information was only partially accurate for all of the fabrics which were labeled. The information acquired from the salespersons concerning the 32 fabrics was accurate for 4, totally inaccurate for 4 and partially accurate for 24.

In 61 per cent of the cases of partially correct information, the inaccuracies were due to the failure to designate the type of rayon as viscose, cuprammonium or cellulose acetate rayon. Of the cellulose acetate rayons, 50 per cent were designated as such; 33 per cent of the cuprammonium rayons were sold under the trade name, Bemberg, but none as cuprammonium rayon; and all of the viscose rayons were merely designated as rayon.

One mixed fabric of the 42 purchased was labeled with the percentage fiber content, and that information was only partially correct.

Table 1. Mixed fabrics of various combinations of two fibers identified as to fiber content, percentage of each present as determined by appropriate method of analysis and information on each given by salesperson or on labels.

Number	Fabric	Identification of Fiber	Information on Label	Salesman's Information	Value of Information	Method of Analysis	Percentage of Fiber Content
1	Alpaca	2-ply yarns of 1-ply acetate, 1-ply viscose	None	Rayon acetate	Partially accurate	Acetate dissolved in acetone	57 Acetate 43 Viscose
2	Alpaca	2-ply yarns of 1-ply acetate, 1-ply viscose	None	Alpaca rayon	Partially accurate	Acetate dissolved in acetone	55 Acetate 45 Viscose
3	Basket weave dress fabric	2-ply yarns of 1-ply acetate, 1-ply viscose	Hop-saki rayon	None	Partially accurate	Acetate dissolved in acetone	66 Acetate 34 Viscose
4	Crepe	Warp acetate Filling viscose	Pure dye acetate	None	Partially accurate	Acetate dissolved in acetone	64 Acetate 36 Viscose
5	Crepe	2-ply yarn of 1-ply acetate, 1-ply viscose	None	Silk and synthetic	Partially accurate	Acetate dissolved in acetone	57 Viscose 43 Acetate
6	Crepe	Warp acetate Filling viscose	Acetate and fine rayon crepe	None	Partially accurate	Acetate dissolved in acetone	56 Acetate 44 Viscose

Table 1. (Continued.)

7	Novelty crepe	2-ply yarns of 1-ply acetate 1-ply viscose	Spun rayon and acetate	None	Partially accurate	Acetate dissolved in acetone	53 Viscose 47 Acetate
8	Novelty crepe	Warp acetate Filling viscose	None	Rayon	Partially accurate	Acetate dissolved in acetone	51 Viscose 49 Acetate
9	Novelty crepe	Warp acetate Filling viscose	Rayon and acetate	None	Partially accurate	Acetate dissolved in acetone	50 Viscose 50 Acetate
10	Novelty crepe	Warp acetate Filling viscose	None	Rayon and acetate	Partially accurate	Acetate dissolved in acetone	50 Viscose 50 Acetate
11	Satin	Warp acetate Filling viscose	Rayon and acetate	None	Partially accurate	Acetate dissolved in acetone	73 Acetate 27 Viscose
12	Satin	Warp acetate Filling viscose	None	Rayon acetate	Partially accurate	Acetate dissolved in acetone	70 Acetate 30 Viscose
13	Spun rayon dress fabric	Blend of acetate and viscose	None	Rayon	Partially accurate	Acetate dissolved in acetone	91 Viscose 9 Acetate

Table 1. (Continued.)

14	Twill	Background viscose stripe acetate	None	Spun rayon and Snia yarn	Partially accurate	Mechanical	95 Viscose 5 Acetate
15	Crepe	Warp acetate Filling cuprammonium	None	Bemberg and Eastman acetate	Partially accurate	Acetate dissolved in acetone	56 Acetate 44 Cuprammonium
16	Crepe	2-ply yarns of 1-ply acetate, 1-ply silk	None	Rayon and silk	Partially accurate	Acetate dissolved in acetone	73 Acetate 27 Silk
17	Figured satin slip material	Warp silk Filling viscose	Bemberg and silk	None	Partially accurate	Silk dissolved in Lowe's reagent	51 Silk 49 Viscose
18	Suede cloth	Warp viscose Filling silk	None	Silk and rayon	Partially accurate	Silk dissolved in Lowe's reagent	60 Viscose 40 Silk
19	Velvet	Silk back Viscose pile	None	Silk back, rayon pile	Partially accurate	Silk dissolved in Lowe's reagent	80 Viscose 20 Silk
20	Medium weight dress fabric	2-ply yarns of 1-ply viscose, 1-ply cotton	None	Crease-resistant linen	Inaccurate	Mechanical	75 Viscose 25 Cotton

Table 1. (Continued.)

21	Flannel	Cotton back viscose and cotton nap	None	Wool and cotton flannel	Partially accurate	Viscose dissolved in Ca(CNS)$_2$	93 Cotton 7 Viscose
22	Coating	Blend of wool and viscose	None	Wool and cotton	Partially accurate	Viscose carbonized with AlCl$_3$	58 Wool 42 Viscose
23	Novelty dress fabric	2-ply yarns of 1-ply wool, 1-ply viscose	None	Wool and rayon	Partially accurate	Viscose carbonized with AlCl$_3$	71 Wool 29 Viscose
24	Novelty dress fabric	Blend of wool and viscose	None	Wool and rayon	Partially accurate	Viscose carbonized with AlCl$_3$ Microscopic by weight	58 Viscose 42 Wool
25	Novelty woolen	Blend of wool and viscose	None	Wool and cocoanut	Partially accurate	Viscose carbonized with AlCl$_3$	60 Wool 40 Viscose
26	Novelty wool crepe	Wool background 2-ply novelty yarns of 1-ply wool, 1-ply viscose	None	Wool and rayon	Partially accurate	Viscose carbonized with AlCl$_3$	88 Wool 12 Viscose
27	Twill	Blend of wool and viscose	Spun rayon and 25% wool	None	Partially accurate	Wool dissolved in KOH	85 Viscose 15 Wool

Table 1. (Continued.)

28	Jersey	Double yarn 1 yarn wool 1 yarn cuprammonium	None	Silk and wool	Partially accurate	Mechanical separation	55 Cuprammonium 47 Wool
29	Novelty coating	Background wool 3-ply novelty yarn of 1-ply mohair, 2-ply wool	None	All wool, angora overshot	Accurate	Mechanical separation	57 Wool 43 Mohair
30	Alpaca	Warp cotton Filling wool	None	Genuine English alpaca	Inaccurate	Mechanical separation	71 Wool 29 Cotton
31	Alpaca	Warp cotton Filling wool	None	Perhaps mohair	Inaccurate	Mechanical separation	76 Wool 24 Cotton
32	Flannel	Blend of wool and cotton	None	Wool and cotton	Accurate	Wool dissolved in KOH	55 Wool 45 Cotton
33	Printed dress fabric	Blend of linen and viscose	Pure linen and spun rayon	None	Partially accurate	Microscopic by weight	68 Viscose 32 Linen
34	Gauze	Blend of wool and linen	None	Wool and linen	Accurate	Linen carbonized with $AlCl_3$	78 Linen 22 Wool

Table 1. (Concluded.)

35	Crash	2-ply yarns of 1-ply linen, 1-ply cotton	None	All linen	Partially accurate	Mechanical separation	73 Linen 27 Cotton
36	Towelling	Linen with colored cotton stripe	All pure linen	None	Partially accurate	Mechanical separation	94 Linen 6 Cotton

Table 2. Mixed fabrics of v rious combinations of three fibers identified as to fiber content, percentage of each present as determined by appropriate method of analysis and information on each given by salesperson or on labels.

Number	Fabric	Identification of Fiber	Information on Label	Salesman's Information	Value of Information	Method of Analysis	Percentage of Fiber Content
1	Coating	2-ply yarns of 1-ply cotton, 1-ply wool and viscose	None	Wool and cotton	Partially accurate	Viscose dissolved in $Ca(CNS)_2$ Cotton carbonized with $AlCl_3$	52 Wool 33 Cotton 15 Viscose
2	Embroidered Crepe	Warp acetate Filling viscose Embroidery cotton and viscose	None	Rayon	Partially accurate	Cotton removed mechanically Acetate dissolved in acetone	48 Acetate 46 Viscose 6 Cotton
3	Hopsacking	Blend of viscose wool and silk	None	All cotton	Inaccurate	Silk dissolved in Lowe's reagent Wool dissolved in KOH	83 Viscose 9 Wool 8 Silk

Table 2. (Concluded.)

4	Novelty knit dress fabric	Blend of silk wool and rabbit hair	None	Wool, angora and silk	Accurate	Silk dissolved in Lowe's reagent Microscopic by weight	58 Silk 36 Wool 6 Rabbit hair
5	Plain weave dress fabric	Blend of viscose wool and acetate	None	All wool, lustrous hair may be Camel's hair	Partially accurate	Viscose carbonized with $AlCl_3$ Acetate dissolved in acetone	70 Viscose 26 Wool 4 Acetate
6	Wool dress fabric	Warp cotton and cuprammonium Filling wool	None	Wool and rayon	Partially accurate	Cuprammonium dissolved in $Ca(CNS)_2$ Cotton carbonized with $AlCl_3$	49 Wool 39 Cotton 12 Cuprammonium

CONCLUSIONS

1. Labeling of mixed fabrics with regard to fiber content was found to be inadequate.

2. At the present time the consumer must obtain most of his information from the salesperson rather than from labels.

3. The greater part of the information concerning fiber content given on the labels and by salespersons was only partially correct.

4. The rayons were seldom designated as viscose, cuprammonium and cellulose acetate rayon.

5. Little information in regard to the percentage of fiber content of mixed fabrics was available.

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HALL BOND

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